

NEST LIFE OF THE BANK SWALLOW

BY LEONARD K. BEYER

The Bank Swallow (*Riparia riparia* (Linnaeus)) is the smallest of our six species of swallows in eastern North America, and while not as brilliantly colored as most of the others it is in some ways the most interesting, particularly in its habit of nesting in colonies, sometimes of hundreds of pairs, in sand and gravel banks. Intrigued by the grace and charm of this bird, and by its cleverness in excavating a nest burrow far into the vertical sides of a hard bank, I determined to make it the object of a detailed study as a part of my graduate work in ornithology at Cornell University.

In June of 1932 I located three small colonies of Bank Swallows nesting in sand banks near Milton, Northumberland County, Pennsylvania. These banks were being worked on a small scale for commercial purposes. I was told by residents of this section that years before, when the sand bank owners were prospering and shipping out sand by the carload, Bank Swallows nested there by the hundreds. The sand at this place is coarse in texture and rather loosely packed, and the weather, in a few months after the operators ceased working at a given point, would wear down the vertical faces of the banks to a slope unsuited to the nesting of the swallows. Consequently the Bank Swallow population of this section was directly dependent on the amount of commercial activity in the sand banks. Of course many nests were destroyed by the sand diggers, but the nesting sites made available by their activities seemed to more than compensate for this destruction.

From a blind placed only a few feet in front of the entrances I observed burrow excavating and nest building. Both birds of a pair took part in the work. A bird would begin by clinging to the vertical face of the bank with feet and tail and pecking at the dirt with a side-to-side motion of the head. When the opening was deep enough for it to get partly inside it would use its feet also, kicking the loosened sand backward in vigorous little spurts. As the tunnel became deeper the bird disappeared from sight, but still the sand came spurting out as evidence of the work of the little miner inside.

Bank Swallows seem to take the work of excavating their burrows very lightly, more like play than work. Indeed, an eager holiday spirit seems to pervade the flock. A swallow will work vigorously for a few minutes, the while many of its comrades are circling about over the bank talking to each other in their reedy, buzzing twitter. Soon it

can no longer resist the temptation and it flies out for a ride through the air with them. But usually not for long, and after a few minutes it returns to its job. These activities continue throughout the day, though at intervals the entire flock may leave the bank for a time. As evening comes on they fly away to some favorite roosting place in a nearby marsh.

In the early stages of burrow excavation some fighting occurs among the occupants of a nesting site, apparently in settling territorial claims to desirable burrow locations. The contestants peck each other vigorously and sometimes fall together to the earth in front of the bank in the intensity of their struggles. Soon one succeeds in demonstrating its mastery over the other and the defeated bird flies away, though no apparent damage has been done to either.

After a few days of these activities some of the birds begin to carry straws and grasses into their burrows. At this stage, when just completed, the burrow is about $2\frac{1}{2}$ inches wide by $1\frac{1}{2}$ inches high, somewhat flattish across the top and more rounded below. As the burrows become older, however, they lose this form, especially about the entrance, because of wearing due to use by the birds and by erosion, so that the opening tends to become larger and rather rounded, particularly in such loosely packed sand as that in the sand banks near Milton. The depth of the burrows here averaged about thirty inches, though some were much deeper and one reached forty-three inches. Usually the burrow slopes slightly upward or bends gently upward a few inches back from the entrance. This is a decided advantage in that it prevents rain water, during heavy storms, from running into the burrows and flooding the nests. However, I have found a number which had no perceptible upward slope or bend.

The straws and grasses are used for the body of the nest, which is placed in an enlargement at the inner end of the burrow. Later the birds carry in feathers to be used as a soft lining for the nest. The feathers are almost always white ones, though occasionally one finds dark ones such as those of Barred Plymouth Rock fowls, or blue pigeon feathers.

One wonders where the birds get all the feathers. They seem to have no trouble finding them, for in addition to all they use in the nests one finds many scattered around on the ground in the vicinity of the nesting site. They seem to enjoy playing with them. One day in early June I saw a white feather floating high in the air just above a bank where a large colony of Bank Swallows was located. Suddenly a swallow darted at the feather, caught it and carried it a short dis-

tance, and then released it. Another bird caught the feather and released it, and then another and another. At last, apparently tiring of the game, one caught the feather and carried it into its burrow. Many of their activities during the early part of the nesting season seem to be carried on for the pure fun of it. They seem to like to poise on beating wings before the face of the bank where their nests are located, holding their positions for a few seconds and then wheeling away out over the nearby fields, only to return soon again to repeat the performance. This they do in companies of eight to a dozen or more.

One of my purposes was to observe the nest life of the Bank Swallow at close range. Because their nests are placed so deeply in sand or gravel banks this was much more difficult to accomplish than it would have been with almost any other kind of bird. However, I believed it would be possible to dig a pit down from the top of the bank to some distance below the level of the nests, work carefully forward until one came to the nests from the rear, and then make a small opening into the nest cavity through which to make observations. Accordingly, after waiting several days to allow time for eggs to be laid and incubation to get under way, I began a pit some four feet back from the edge of the bank. The burrows were scattered irregularly over the face, some being not much more than a foot from the top while others were six or seven feet down. When I reached a depth of several feet I began to work carefully forward toward the nests, using a trowel. The sand was of uniform texture throughout, with no roots except those of grasses and dewberry plants near the surface, making the digging a rather easy job.

The first nest I came to had five pure white eggs, but the next one had recently hatched young. I plugged the openings into both nests with rags, hurriedly arranged a covering over the opening of the pit above so as to darken it, with myself inside, and sat down in the earthly darkness to await developments. The birds had been more or less disturbed by my digging operations, but now that all was quiet again they soon returned and I could hear their twittering outside. Before long I heard twittering in the nest that contained young, only a few inches away beyond the rag plug. Carefully pulling the rag so as to make a tiny opening I cautiously looked in, and there in the semi-darkness saw the parent bird brooding the young. What a thrill to be so near!

It was very difficult to avoid disturbing the parent bird and several times it left the nest hurriedly, though it always returned before long. Sometimes it brought food for the young, so that I was able to observe



FIG. 20. Adult Bank Swallows at the entrances of their burrows.



FIG. 21. Nest and eggs of the Bank Swallow, as opened, showing the entrance burrow leading off to the right.

both brooding and feeding this first day. Fearing that too prolonged observation at this stage might cause the old birds to desert I decided to go home and leave them until the next day to become accustomed to the new arrangements. I closed the rear opening into the nest cavity with a square of old linoleum held in place with sharp sticks pushed into the sand, and after crawling out of the pit covered it with a big piece of old linoleum. Before leaving the place I had to build a rude fence around the pit to prevent certain cows, which were pasturing in the field and which had been showing altogether too warm an interest in my investigations, from falling into it.

I returned to the sand bank on the afternoon of the following day with great anticipations, but to my keen disappointment found the nests deserted. Apparently my extensive mining operations disturbed the birds too much. Perhaps tiny drafts of air blowing through their burrows and over the nests, which I was not able entirely to prevent after they were opened from behind, caused the desertion. At any rate my hopes of studying the nest life of the Bank Swallow this season were not to be realized, and it was not until two years later that I succeeded in observing it from hatching time until the young left the nest.

The summer of 1934 I spent at Sodus Bay on the southern shore of Lake Ontario, where Bank Swallows nested by the thousands in the high bluffs that face the lake. The soil here is much harder for the birds to dig than the sand banks at Milton, being a tightly packed boulder clay of glacial origin with many pebbles and larger stones scattered through it, and as a result the nest burrows are not nearly so deep as those in the easily worked sand at Milton. I measured many burrows and found them to range from fourteen inches to eighteen and one-half inches in depth. Some were placed only a few inches from the top of the bluff in the humus-bearing soil to be found there, while many others were to be found farther down the face of the bluff. Not nearly all the burrows were occupied, since many of them had to be abandoned because the birds had met rocks or roots before the burrows were deep enough, making it necessary for them to start over again in a new place. Occasionally, however, they would detour around the obstruction by bending the burrow to one side.

After a little search I found a place favorable for my mining operations. A pit was dug a short distance back from the edge of the bluff, deep enough that it would be possible to sit in it for several hours with a fair degree of comfort while making observations. This time I planned to fill the pit with soil up to a point above the level

of the nests after each observation, to prevent the possibility of drafts blowing through the burrows. As the nests here were only a few inches below the top of the bluff it was not necessary to make the pit very deep, so that the labor of shoveling the dirt out of the pit and in again each day was not prohibitive.

On the day, June 23, when the excavation was made into the two nests included in the pit, there were two-day old nestlings in the nest on the left and newly-hatched young in the nest on the right. The new openings into both nest cavities were plugged with rags to prevent drafts from blowing over the young birds and also to give the old birds time to become accustomed to the changes in the rear of the nest cavities. Then I covered the pit, myself inside, with two thicknesses of tent canvas and sat down to await the birds' pleasure. In less than half an hour I heard the low-pitched reedy twittering of an adult Bank Swallow in the nest on the right—the one with newly-hatched young. With extreme care I pulled the rags slightly to one side, making a little opening through which I could see one of the old birds brooding the young. Later I enlarged the opening until it was more than an inch across. This startled the bird and it flew out, but soon returned. Occasionally both parent birds were in the nest cavity together. They seemed greatly mystified and somewhat disturbed by the strange developments at the rear of their nest cavity and several times one of them came to the opening and put its head through, peering inquiringly into my partially darkened pit. These two nests were only a little more than a foot in from the face of the bank and this short distance allowed a good deal of light to penetrate into the pit through the burrow and nest cavity. Once or twice I had to put my hand to the opening to keep one of the birds from falling into the pit with me.

The newly-hatched birds in this nest were pink in color, with a scanty covering of gray down on the back of the head and neck, base of wings, and top of back. The eyes were very large and showed black through the closed lids. The inside of the mouth and the flanges on the bill were lemon-yellow, the bill yellowish-gray, the feet pinkish-gray. The tiny nestlings appeared quite weak and it seemed to be only with the greatest effort that they were able to raise their immense wobbly heads for the food their parents brought them.

The old birds did not return to the nest on the left, in which the young were two days old, until after an hour or more. Before leaving for the day I plugged both openings tightly with rags and shoveled the removed dirt back into the pit.

When I returned the next day I put a glass window in the opening to the nest on the right, holding it in place by means of sharpened hooked sticks which I pushed firmly into the soil. The opening into the nest cavity through the glass was now an irregular one about three inches deep by four inches wide which allowed a clear view of all that went on in the nest cavity from within the pit. When the old birds returned to the nest they seemed much puzzled by the shiny glass at the back of the nest cavity. They came back to it, one at a time, and pecked at it, no doubt disturbed by the reflections of themselves which they must have seen in the glass against the dark interior of the pit. But after a short time they accepted this new arrangement and went about their duties of feeding and caring for their young, though returning now and again to peer wonderingly into the glass and peck at it.

During the hour which I spent in the observation pit the young were fed several times on small flies, the parent placing the food far down into the mouths of the nestlings. One of the parent birds remained on the nest nearly all the time, brooding the young while the other was foraging for food. When the latter one returned to the burrow, giving its low cheerful twitter upon reaching the entrance, the bird that had been brooding flew out for a short time, usually returning before the one that had brought food was gone. Judging from their actions and from the fact that the bird that brought in the food was somewhat more active and more alert and masculine in appearance than the one that did most of the brooding I believe it safe to call it the male, and the one that brooded the young most the female. Later observations tended to uphold this view, though not to prove it conclusively. Male and female Bank Swallows look so much alike that it is impossible to tell them apart with certainty without killing and dissecting them.

It was necessary for me to be away from Sodus Bay for the next two days, but Mr. William Montagna, then a student at Bethany College and a keen bird man who was helping me during the summer's study, spent a part of each day in the observation pit. He found the nest on the left deserted, but everything was all right in the one on the right, where I had placed the glass window the day before. As happened then one bird, apparently the female, remained on the nest most of the time to brood the young while the other, apparently the male, foraged for food. When he returned she usually left the burrow for a moment, coming back about the time he had finished feeding the young. Sometimes she would remain outside longer and then the male

would brood the young until her return. When returning from these short trips outside the female sometimes brought food also.

Sometimes while the female was brooding the young the male would squeeze himself in beside her on the nest and then actually push her off. She would leave reluctantly and return in a few seconds. Sometimes while the male was foraging he would come back to the entrance of the burrow, twittering cheerfully, look in for a second or two as if to see that everything was all right, then fly away.

When entering the burrow with food the male calls in a series of peculiarly sweet, fine notes much higher in pitch than the usual Bank Swallow call. This seems to be the food call to the young, for upon hearing it they raise their heads with mouths wide open. That is, if they are hungry. At times they do not seem to be hungry and give no response to the call. Then the male does a most surprising thing—he lightly tramps over them, gently kicking them as though to awaken them out of their sleepiness, calling sweetly all the while. Soon one or another raises its wobbly head, opens its mouth, and the food is deposited within.

On the next day, the fourth for our observations, feeding went on just as it had the day before, the male foraging while the female remained in the nest to brood the three young. Feeding occurred on an average of twice every five minutes, the diet consisting mostly of small flies and caddicee flies. The parent birds, on this as well as the previous days, swallowed the small packets of excrement voided by the nestlings. Sometimes the female, after inspecting and cleaning the nest, would walk forward from it some distance in the burrow and then back up over it, spreading her feathers over the young to brood them.

On the fifth day, which was really the day when the young were four days old, I heard for the first time the call notes of the nestlings, weak and rather frequent and resembling somewhat the food call of the old birds. As on previous days, the male did nearly all the feeding, the female bringing food only three or four times during a two-hour period. The food was of the same character as that of the day before, mostly of flies and caddicee flies, which often protruded from the old bird's mouth when it entered the burrow. The parent gave all the food brought on a single trip to but one offspring, not dividing the load among two or more as do many small birds. Only for short periods were both parents absent from the nest, seldom for more than a minute at a time. As before, the male brooded the young for short periods while the female was out of the burrow, and he, while brood-

ing, nearly always sat facing out. The female while brooding often faced in.

As the days passed the character of the food brought to the young gradually changed, probably due mainly to changes in the relative abundance of various kinds of insects in the vicinity. On the sixth day a brood of may-flies emerged along the lake shore and these insects began to appear in the diet. The young birds, now five day old, required less brooding, for on several occasions both parents were absent from the nest. At this age the feather sheaths have appeared in the feather tracts but as yet none of them have burst. The nestlings are much more stronger and noticeably larger, and their eyes are open though they keep them closed most of the time. Sometimes both parent birds returned to the nest at the same time, each carrying food. On one trip one of them brought a white feather and spent some time working it into the texture of the nest.

Each day the young birds were becoming more active, and their appetites larger. Their parents no longer needed to resort to the old trick of tramping over them to arouse them to take food. On the day they were six days old their food consisted mostly of may-flies. Both old birds were out of the burrow during most of the observation period, brooding the young for only two or three very short periods during the hour and ten minutes which I spent in the pit. They fed the young frequently for a while and then not so often, sometimes not more than once in ten minutes. Again one of the parents brought a white feather which it added to those in the nest, working it carefully in and rearranging the others. They no longer swallowed all the excrement of the young, but carried much of it outside the burrow.

On June 30, when the nestlings were seven days old, I spent from 7:05 A. M. to 9:45 A. M. in the observation pit, a period of two hours and forty minutes. Neither of the old birds returned until 8:15 A. M., leaving the nestlings alone for an hour and ten minutes. I was beginning to fear they had deserted, but after they did return they came regularly, feeding the young ten times in an hour. At no time were both birds in the burrow at the same time. Brooding had become less needful each day as the young grew older, and on this day what little brooding was done was for very short periods only, usually for less than a minute. The female, relieved of the necessity of remaining so much in the burrow to brood, took a more active part in the feeding operations. The food seemed to be exclusively may-flies on this day. The parent birds no longer swallowed any of the excrement of the young, but carried it away from the burrow each time. At this age of

the young many feathers in the dorsal tract have burst their sheaths, and also a few of the wing and tail feathers.

The following day I spent an hour and a half in the observation pit. Feeding occurred twelve times during the first hour, but after that neither of the old birds returned. In fact the parents leave their young alone for more or less extended periods during this stage of their development, as we saw by their absence for an hour and ten minutes on the day before. The young birds have become increasingly active each day. On this day they moved quite freely about the nest cavity, especially to void excrement. In performing this act they nearly always moved forward toward the entrance of the burrow, though occasionally one of them would come to the back of the nest cavity and leave the capsule of waste matter against the glass of the window. As during the day before all excrement was carried out of the burrow by the old birds, none of it swallowed. The young birds usually answered the calls of their parents given as the latter came through the entrance. Their voices had now begun to resemble those of adult Bank Swallows. Sometimes when they did not respond to the food call of the parent the old bird gave a very soft, high-pitched call that was exceedingly musical and sweet.

During the observation period on the next day the old birds were away most of the time, feeding the young only once in the space of an hour. The nestlings were very hungry and at the appearance of one of the parents at the entrance with food rushed toward it down the burrow with mouths widely open. Now nine days old, they had become rather well feathered, most of the body feathers and many of the wing and tail feathers having burst their sheaths. However, their appearance was rough and unkempt, for the feathers were only partly grown and the scanty natal down still clung to the tips of many of the feathers.

On July 3 the young, then ten days old, were very active and hungry, stretching their necks, opening their mouths, and calling eagerly for food when an old bird appeared at the entrance. They were fed thirteen times in an hour, the food being practically all may-flies. They moved freely about in the nest cavity, one or two of them frequently getting outside the nest proper and pressing against the dirt wall of the cavity or the glass window at the back. At other times all three young birds lay quietly in the nest for a time, later to resume their restless movements. Fleas (*Cerathophyllus riparius* J. and R.), which breed abundantly in the nest material, seemed to cause them some annoyance, for the pests were often seen crawling about

over the birds. Mites also infested them, and their frequent scratching and picking at themselves were doubtless caused by the attacks of these parasites.

On the next day I observed activities in the nest from 9:40 A. M. to 11:50 A. M. The old birds did not return until 10:26, but after that they came very often, thirteen times in half an hour. The young were exceedingly active, especially when food was brought. The parents did not brood them at all any more. I exploded several photoflash bulbs in an attempt to secure flashlight pictures and neither the old birds nor the young seemed to be disturbed by the sudden brilliant flash of light. But when I removed two of the nestlings, leaving only one in the nest, the old bird was much puzzled and looked anxiously about the cavity for the missing young. I soon returned them to the nest and then the parents seemed satisfied again.

No visits were made to the nest on July 5, but the entire day of July 6, from 5:00 A. M. until 8:00 P. M., was spent in the observation pit. Thus far the daily observations had been for periods ranging from an hour to nearly three hours, sometimes in the forenoon and sometimes in the afternoon. It seemed that an entire day, from dawn to dark, spent in observation of the nest activities might give an insight into the daily life of the birds that we were missing in our shorter daily periods. We decided to work in two-hour shifts, I to take the first one from 5:00 A. M. to 7:00 A. M., Mr. Montagna the second, from 7:00 A. M. to 9:00 A. M., I the third, he the fourth, and so on. As it happened, we chose what turned out to be the hottest, most oppressive day of the entire summer for our day-long vigil, a day of great humidity and intermittent thunder showers, with periods of warm sunshine between the showers. The conditions on such a day within the narrow confines of the observation pit, covered over by two thicknesses of canvas, can hardly be imagined. I learned that day what it means to sweat from every pore.

It was raining slightly from a nearby thunderstorm when we arrived at the bluff where the observation pit was located at 4:25 A. M. No swallows were flying about as yet. But it was necessary for us to return to camp for some forgotten equipment and when we came back at 4:45 A. M. many of the birds were coursing about above the bluff and over the lake. We opened the pit and found only two young birds in the nest. Later search at the foot of the bank in front of the burrow disclosed the fate of the missing one—it had fallen out of the entrance of the burrow and been dashed to its death on the hard soil below. Young Bank Swallows of this age often rush toward the en-

trance to meet one of their parents returning with food, and it was probably in this way that the accident occurred.

The remaining nestlings were thirteen days old on this day. They were quite well feathered, with a considerable amount of natal down still clinging to them. They spent a good part of the time moving about, exercising by stretching wings and legs, and preening their feathers. At other times they rested sitting in the nest, or leaning against the dirt wall of the nest cavity or the glass of the window. Sometimes one of them would press itself hard into the corner formed where the glass of the window met the earth of the cavity wall. At other times they would lean against each other, eyes shut and heads drooping in the most comical fashion. The day was very warm, causing them to pant from the heat.

But when the call of one of the old birds was heard at the entrance both nestlings became eagerly alive, often rushing forward to meet the parent for the food. They were nearly always fed alternately. This was not due to any choice on the part of the parents, but to the habit of the young bird just fed retiring to the back of the burrow and the other moving forward to be in the most advantageous position when next a parent returned with food. Once in a while this method of alternating did not work, mainly, I think, because the young bird whose turn it was to be fed next was not hungry enough to move forward where it would be the first to meet the returning parent.

During the fifteen hours that the nest was under continual observation food was brought one hundred and fifteen times. Except for several fairly long absences from the nest of eleven to fifty-five minutes occasioned by outside disturbances such as our changing watch at the end of each two-hour interval, the arrival of campers at their tent nearby, and their engaging in target practice, the length of time between feedings ranged from one to fifteen minutes, averaging somewhat less than five minutes for the day. Several times both parents came at the same time with food. May-flies again seemed to be the main article of diet. Occasionally one would be dropped while being passed from parent to young and it would struggle, in a more or less mutilated condition, along the floor of the burrow toward the entrance. Neither the young nor old birds would pay any attention to it.

During the period from 5:00 P. M. to 7:00 P. M. feeding occurred more often, many times at only one-minute intervals. But after 7:00 P. M. no more visits were made by the parents that day.

Twice during the day a grass stem was brought and added to the nest, and once a feather. Excrement was removed whenever voided by the young, each time by carrying to the outside.

Outside the pit it was noticed that at about 7:30 p. m. a general movement of the swallows flying about began down along the shore of the lake toward the marshes on Sodus Bay. They did not all leave at once, but the number diminished gradually until by 7:50 p. m. they were all gone. I did not see any birds fly into the burrows after 7:30 p. m. though several flew out to join those leaving the bluff. Apparently after the young birds are fairly well grown and no longer require brooding the parents leave them for the night, joining other adult birds from their own and other colonies in the vicinity to roost together in the marshes.

At 8:00 p. m., all the adult swallows having gone to their roosting place and darkness about to fall, we closed the observation pit and ended our work for the day.

No observations were made at the nest on the next day, July 7, and when I went to the observation pit on July 8 there was only one young bird in the nest. It was fifteen days old, fully feathered, and practically all the natal down was gone. It walked easily about the nest cavity and burrow, and exercised its wings frequently. The fate of the other nestling I do not know. It may have fallen from the burrow entrance, although I did not find its body at the foot of the bank, or it may have been tempted to try its wings too early.

On July 10, when the young bird was seventeen days old, I spent from 8:35 a. m. to 10:05 a. m. in the pit. During this period it was fed seven times. Several times it ran out to the entrance to call to its parents but usually backed into the burrow when one of them brought food. I worked with the glass window out on this day and once it fell through the opening into the observation pit. It apparently was not excited by this but lay still where it fell until I picked it up, and then sat for several minutes on my hand at the edge of the nest cavity. The old birds were no longer removing excrement and the nest was becoming rather unclean.

When I went to the observation pit on the morning of July 11, eighteen days after the young had hatched, I found the last nestling gone and the nest deserted.

From the data secured in the daily observations at the nest can be made certain general statements concerning the nest life of the Bank Swallow. When the young are first hatched, and for four or five days thereafter, they are brooded almost continuously, apparently by the

female, while the other parent, apparently the male, forages for food. When the male comes with food the female often flies out for a brief time, usually returning by the time he is through feeding the young. If she has not come back by that time he remains to brood them until she arrives. Occasionally she brings food with her.

The food the first few days consists of small soft-bodied insects. In the nest under observation it was mostly of small Diptera. Feeding occurs quite often, averaging twice every five minutes in this nest of three young. Only one young is fed at a visit—that is, all the food brought by the parent on one trip is given to one young. When entering the burrow with food the parent calls in a series of sweet high-pitched notes to the young. If the young are not hungry the parent calls more insistently, at the same time trampling them gently to arouse them.

As the young get older they are brooded less and less, by the sixth day scarcely at all. When brooding is no longer necessary both birds seem to share about equally in the feeding. Many times they both return at the same time with food.

In the nest under observation the food during the middle and latter part of the time spent in the nest seemed to consist almost entirely of may-flies, which were very abundant along the shore of the lake at this time. From the studies of other investigators, notably those of Dayton Stoner on the Bank Swallows of the Oneida Lake region in New York, we know that the food of nestlings includes a variety of other kinds of insects, especially high in those of the orders Diptera, Coleoptera, and Homoptera.

During the first five or six days the small packets of excrement voided by the nestlings are swallowed by the old birds, but throughout the remainder of the time the packets, larger now, are carried outside. During the last two or three days they are not removed at all and the nests soon become quite filthy. This was true of the nest observed from the pit as well as of many others observed from the outside.

Early in life the young birds begin to call, in very weak notes at first. As they become older they call more loudly and gradually their notes come to resemble the characteristic cedy twitter of the adults of the species.

As the young get older they become increasingly active, moving about the nest and nest cavity and later out into the burrow, exercising legs and wings. During the latter part of the time spent in the nest they preen and pick at their feathers a good deal. Young birds are occasionally lost by their moving too far out of the burrow and

dropping to the foot of the bank below. One was thus lost from the nest under observation. Search at the foot of a bank occupied by these swallows during the latter part of the nesting season shows that a number are killed in this way.

Bank Swallows leave their young alone in the burrows at night after they are partly grown, the adults flying away to roost with others of their kind in a marsh.

The old birds keep bringing new feathers and straws or grass stems to add to the nest until a few days before the young leave.

Young Bank Swallows usually remain in the nest until the eighteenth day after hatching, sometimes two or three days longer. By the fourteenth day they are completely feathered with some of the natal down still clinging to them, but this is gone by the sixteenth day. They can fly by the sixteenth day, though not for more than a few minutes at a time. One that escaped from us at this age flew far out over a field but lacked endurance and gradually lost altitude until it came to earth. But by the eighteenth day they can fly quite strongly.

Many times we witnessed what apparently was the initial flight of a young bird. Swiftly it would dart from the burrow and course out over the lake. The old birds flying about seemed to know that this was the first flight of a fledgling for quickly one or two of them would fly close to the young one and follow it. These first flights were noticeably more erratic than those of the older birds. One young bird that took to the air a little too soon could not maintain itself in flight but gradually came down until it fell into the rough waters of the lake. I was unable to learn the fate of this one; it was probably drowned or beaten to death by the waves. But when a young Bank Swallow falls into still or fairly still water it swims easily to land.

Before they are fully fledged young Bank Swallows are entirely without fear, but about the fourteenth day the fear instinct begins to appear. Fledged birds will crouch as far back in the nest cavity as possible when one reaches into a burrow, or, seeing a shadow darken the entrance, they will sometimes fly out, sometimes on unsteady wings. After capture, however, they will submit to considerable handling if it is done carefully, even posing quietly on a stick for a photograph. When returned to the entrance of the burrow they run eagerly back into its dark interior.

According to many writers some of the birds in a colony of Bank Swallows rear a second brood. Dayton Stoner, who has done some very careful work with Bank Swallows in connection with bird banding

operations in Iowa,¹ and later in the Oncida Lake region of New York,² believes that the rearing of two broods in a season is a fairly common occurrence. He found newly hatched young in northwestern Iowa as late as August 5, and this certainly looks as though a second brood were being reared. In my own experience, however, I found no evidence of second broods though I looked persistently for them throughout July and August in the Sodus Bay region. Here many young birds were on the wing by late June and by that time flocking had begun, great numbers of both old and young birds being seen every day resting on telephone wires and power lines. Throughout early July the size of these flocks kept increasing while the number of birds flying about the nesting sites and in and out the burrows kept decreasing. We continued watching the birds at the banks and investigating burrows into which we had seen them fly, but in no case did we find eggs or even unfledged young. On July 26, when the banks were pretty well deserted, we investigated a burrow that was still being used, thinking that here perhaps a second brood was being reared, but it contained fully fledged young birds almost ready to fly.

It is true that Bank Swallows are rather irregular as to nesting dates, some beginning egg-laying even after others have well grown young in the nests. Among the swallows nesting in the bluffs on Lake Ontario near Sodus Bay we did not find any great irregularity, for here the birds were not disturbed, and nearly all the pairs of a colony had finished nesting by July 15. But where Bank Swallows are being more or less continually disturbed by the commercial working of the sand and gravel banks, or by the slumping of the banks due to erosion, it is easy to see that there would be more irregularity in nesting. Possibly some unfortunate pairs would have their nests destroyed repeatedly and not succeed in beginning incubation or producing newly-hatched young until late July or early August, and thus give the impression that a second brood was being reared. It is possible, of course, that an occasional second brood is reared in the same season, but I believe that such an occurrence is rather rare, at least among the Bank Swallows nesting in the vicinity of Sodus Bay.

MANSFIELD STATE TEACHERS COLLEGE,
MANSFIELD, PA.

¹The Auk, Vol. 42, pp. 90-93; Vol. 43, pp. 199-209; Vol. 45, pp. 310-320.

²Roosevelt Wild Life Bull., Vol. 9, No. 2, pp. 122-233.